

Dynamic Posture Change in Non-Specific Low Back Pain Management: A Paradigm Shift Utilizing the Joint-by-Joint Training Approach

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Background: Non-specific low back pain (NSLBP) affects approximately 80% of adults worldwide, posing significant health and socioeconomic challenges. Traditional management strategies focused on static posture correction, but recent advancements suggest a shift towards dynamic posture change using the joint-by-joint training approach (JBJA).

Objective: This review aimed to examine the JBJA model, which seeks to enhance mobility, stability, and motor control by viewing the body as a series of alternating mobile and stable joints.

Methods: The JBJA model views the body as a series of alternating mobile and stable joints. This review examines studies that compare the effectiveness of dynamic interventions promoting movement variability and task-specific postural adaptations versus static posture correction.

Results: Studies revealed that interventions promoting movement variability and task-specific postural adaptations are more effective in reducing pain and improving function compared to traditional static posture correction methods.

Conclusion: The focus on dynamic posture change emphasizes individualized assessment and interventions, aligning with contemporary pain science. Clinicians should prioritize exercises that enhance movement quality, such as promoting hip and thoracic mobility, and educate patients on postural variability. Further research is needed, but the JBJA model shows promise for more effective NSLBP management.

Keywords: Biomechanics; functional movement patterns; kinetic chain; movement variability; musculoskeletal rehabilitation; neuromuscular control.

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1. INTRODUCTION

Non-specific low back pain (NSLBP) remains a pervasive global health challenge, affecting approximately 80% of adults at some point in their lives and imposing

significant socioeconomic burdens (1, 2). NSLBP is defined as low back pain not attributable to a recognizable, known specific pathology (e.g., infection, tumor, osteoporosis, fracture, structural deformity,



inflammatory disorder, radicular syndrome, or cauda equina syndrome) (3). NSLBP can be further classified into acute (pain lasting less than 6 weeks), subacute (6-12 weeks), and chronic (more than 12 weeks) (4). Despite numerous interventions, the persistence of NSLBP often leads to chronic pain and disability, necessitating a reevaluation of traditional management approaches (5). Advancements in biomechanics, exercise science, and pain neuroscience have challenged the paradigm of static posture correction, suggesting instead a more dynamic, individualized, and biopsychosocial approach (6, 7).

The joint-by-joint training approach (JBJA) has emerged as a promising framework for NSLBP management, emphasizing the interconnectedness of the body's kinetic chain (8-10). This model, which views the body as a series of alternating mobile and stable joints, offers a nuanced perspective on the role of posture in pain management (11). However, a critical question arises: Should the focus be on rigid posture correction aimed at achieving an "ideal" spinal alignment, or on fostering adaptive posture change?

Emerging evidence underscores the importance of a holistic, biomechanical approach to NSLBP management (5, 7, 11). The biopsychosocial model, which considers biological, psychological, and social factors in pain experience, has gained significant traction in NSLBP management (12). Nunes et al. (13) emphasize movement variability and task-specific postural adaptations, showing greater efficacy in reducing pain and improving function compared to traditional posture-focused approaches. This evidence suggests a potential paradigm shift in how we conceptualize and address NSLBP.

This brief review explores the efficacy of the JBJA in mitigating NSLBP, examining the shift from traditional posture correction methods to a more dynamic approach of posture change. By exploring the principles of JBJA and its relevance to lower back issues, we aimed to provide insights into how this method can be effectively incorporated into NSLBP management strategies. The exploration of this topic is crucial, given the high prevalence of NSLBP and its impact on quality of life and healthcare systems worldwide.

2. THE JOINT - BY- JOINT TRAINING MODEL: A COMPREHENSIVE FRAMEWORK FOR MANAGING NON-SPECIFIC LOW BACK PAIN

2.1. The JBJA: Definition, Principles and Components

The joint-by-joint training model, popularized by Cook and Boyle, proposes that the body is a series of alternating mobile and stable joints (9, 10, 14). According to this model, certain joints require stability, such as the lumbar spine, while others, like the hips and thoracic spine, necessitate mobility (14). This approach posits that dysfunction in one joint can lead to compensatory issues in adjacent joints, causing pain and impaired movement.

The JBJA focuses on three main components to address dysfunctions and reduce NSLBP:

Mobility: Enhancing the range of motion in stiff joints, particularly the hips and thoracic spine, which are often restricted in NSLBP patients (15).

Stability: Strengthening the core and other stabilizing muscles to provide adequate support for the spine (16).

Motor Control: Improving the body's ability to move efficiently and activate appropriate muscles during functional movements (17).

By addressing these aspects, the JBJA aims to create a more adaptable and resilient musculoskeletal system, rather than enforcing a fixed posture. This adaptability allows individuals to maintain optimal spinal alignment during various activities, thereby reducing the risk of NSLBP.

2.2. A Paradigm Shift in NSLBP Management

In the context of NSLBP, the JBJA signifies a substantial shift from traditional posture correction methods. This model emphasizes the importance of addressing not only the lumbar spine but also the surrounding joints and their functional dynamics (18). Some studies (5, 7, 16) support this integrated approach. For example, a systematic review by Vadalà et al. (19) identified robust evidence for the effectiveness of exercise interventions targeting both the lumbar spine and adjacent joints, particularly the hips and thoracic spine, in managing chronic NSLBP (18).

2.3. Scientific Evidence Supporting the Joint-by-Joint Model

Research provides substantial evidence supporting the JBJA model's effectiveness in managing musculoskeletal

pain and improving functional movement (20). For instance, studies have shown that improving mobility in the hips and thoracic spine can significantly alleviate NSLBP by redistributing mechanical loads and enhancing overall movement patterns (21, 22). Additionally, strengthening stabilizing muscles has been found to reduce the incidence and severity of NSLBP by providing better support for the lumbar spine (23, 24). Moreover, a systematic review by Zang et al. (25) found that exercise interventions targeting both physical and psychosocial factors were more effective in reducing pain and disability in chronic NSLBP patients compared to purely physical interventions.

The JBJA model offers a comprehensive framework for addressing lower back pain by focusing on the interplay between joint mobility and stability. This approach not only targets the lumbar spine but also considers the functional relationships between adjacent joints. By improving mobility, stability, and motor control, the JBJA aims to create a more adaptable and resilient musculoskeletal system, ultimately reducing the incidence and severity of NSLBP.

3. POSTURE CORRECTION VERSUS POSTURE CHANGE: A PARADIGM SHIFT IN JOINT-BY-JOINT TRAINING APPROACH

The JBJA challenges the traditional concept of posture correction, advocating instead for a more dynamic strategy of posture change. This shift represents a fundamental reevaluation of how we conceptualize and address postural issues in the context of NSLBP management.

3.1. Posture Correction: Rethinking the Traditional Paradigm for NSLBP Management

Historically, correcting posture has been central to NSLBP management, emphasizing achieving and maintaining a “neutral spine” position (26). This approach assumes that poor posture significantly contributes to NSLBP, leading to interventions aimed at aligning the body in an ideal posture to minimize lumbar spine stress (27).

Traditional “posture correction” methods include ergonomic adjustments, bracing, and targeted exercises (28). These strategies focus on maintaining lumbar lordosis, avoiding excessive flexion or extension, and achieving proper pelvic alignment. For example, the McKenzie Method (MDT) (29) categorizes patients based

on clinical presentation rather than anatomy, emphasizing patient empowerment and self-treatment. Centralization - a positive sign where symptoms move toward the spine - is a key MDT principle (30). However, research challenges this paradigm. Tagliaferri et al.'s (31) critical review found limited evidence supporting postural correction's effectiveness in reducing NSLBP. The relationship between posture and pain is multifactorial, suggesting a one-size-fits-all approach may oversimplify matters (32). Long-term efficacy of static posture correction is also questioned. Luomajoki et al.'s (33) systematic review and meta-analysis revealed short-term relief but no significant long-term benefit compared to other interventions. Static posture correction may not address dynamic dysfunctions underlying NSLBP (34). Furthermore, fixating on a single “correct” posture ignores individual variability across activities. Biomechanical studies highlight postural adaptability over rigid ideals. Alsubaie et al. (35) demonstrated that greater postural variability during functional tasks led to better pain reduction and functional outcomes in chronic NSLBP.

3.2. Emphasizing Dynamic Posture Change

Contrary to “static posture correction”, the concept of “posture change” prioritizes the body's ability to adapt and move efficiently through various positions, while also considering psychosocial factors that influence movement behaviors (36). This approach aligns with the JBJA model (9, 10), which emphasizes mobility in the hips and thoracic spine to reduce compensatory movements in the lumbar spine (28, 33). By promoting movement variability and task-specific postural adaptations, posture change aims to enhance overall function and reduce the incidence of NSLBP. Research by Altenburger et al. (37) demonstrated that interventions promoting movement variability and task-specific postural adaptations were more effective in reducing NSLBP and improving function compared to traditional postural correction approaches. The aforementioned study (37) suggested that teaching patients to adapt their posture to various tasks and environments may be more beneficial than striving for a single “correct” posture. In the other hand, Parveen et al. (38) revealed that participants who engaged in hip and thoracic mobility exercises experienced a 30% greater reduction in pain compared to those who focused solely on lumbar

stabilization exercises. Another randomized-controlled-trial study (39) highlighted improvements in functional movement and reduced disability in individuals following a JBJA training regimen. Further studies have shown that improving hip and thoracic mobility can significantly decrease NSLBP by redistributing mechanical loads and enhancing overall movement patterns (28, 33). For instance, addressing movement dysfunctions and asymmetries through strengthening weak muscles, such as the glutes, and improving the mobility of tight muscles, such as the hip flexors, can positively impact lower back pain (9).

Functional movement patterns: Addressing movement dysfunctions and asymmetries is essential in the posture change approach (40). Strengthening weak muscles and improving mobility can lead to substantial improvements in NSLBP (40). For example, targeted exercises like hip flexor stretches and posterior pelvic tilts can correct anterior pelvic tilt, restore lumbar lordosis, and reduce strain on the lower back.

Task-specific adaptations: The JBJA encourages dynamic adaptations rather than rigid corrections (41). This means that different tasks and environments require different postural strategies, allowing for greater flexibility and adaptability in managing NSLBP.

3.3. Posture Change, Not Correction

Posture correction, traditionally viewed as a static adjustment to achieve an “ideal” alignment, can be likened to a localized intervention with limited scope. In contrast, posture change embodies a more comprehensive and adaptable approach, emphasizing proper movement mechanics across various functional contexts. This dichotomy reflects a broader trend in biomechanics and rehabilitation science towards more dynamic and task-specific interventions (32, 33). However, it is crucial to note that this shift from correction to change does not negate the value of postural awareness. Rather, it expands the scope of postural interventions to encompass a broader range of movement strategies. The goal is to develop what Hu et al. (42) term “movement confidence” - the ability to move through various postures with ease and without fear of pain or injury. Implementing this approach requires a nuanced understanding of individual biomechanics and functional requirements. Clinicians must consider not only the static alignment of joints but also their dynamic

interplay during functional tasks. This holistic perspective aligns with the fundamental principles of the JBJA, which emphasizes the interconnectedness of the body’s kinetic chain.

In conclusion, the shift from posture correction to posture change reflects a more nuanced understanding of the complexities involved in managing lower back pain. By promoting movement variability and adaptability, posture change offers a more effective and sustainable approach to NSLBP management. This dynamic perspective is supported by research, suggesting that adaptable movement strategies can lead to more significant and lasting improvements in function and pain relief.

4. IMPLICATIONS FOR CLINICAL PRACTICE: SHIFTING FROM POSTURE CORRECTION TO POSTURE CHANGE

The shift from traditional posture correction to dynamic posture change in NSLBP management marks a significant evolution in clinical practice. This new paradigm emphasizes individualized assessment, dynamic interventions, functional training, and comprehensive patient education. This section explores the implications of this paradigm shift for clinical practice, supported by current research and evidence-based approaches.

4.1. Individualized Assessment

Clinicians should adopt a holistic approach by considering the entire kinetic chain, assessing the mobility and stability of adjacent joints according to the JBJA training model. This involves evaluating and addressing deficits in joint mobility, stability, and motor control throughout the kinetic chain, including the foot, ankle, hip, and core (9, 10, 37). Dysfunctional movement patterns, rather than poor static posture, are often the root cause of NSLBP (27). For instance, limited hip mobility can lead to compensatory movements in the lumbar spine during activities such as squatting, exacerbating lower back pain.

4.2. Dynamic Interventions

Treatment strategies should focus on enhancing overall movement quality and adaptability rather than enforcing rigid postural rules (37). Incorporating dynamic interventions helps in redistributing mechanical loads and improving functional movement patterns (39). By

promoting mobility in the hips and thoracic spine and stability in the lumbar region, clinicians can address compensatory movement patterns that contribute to NSLBP.

4.3. Functional Training

Exercises should be task-specific, preparing patients for the varied postural demands of their daily activities. Functional training involves strengthening weak muscles and improving the mobility of tight muscles, thereby enhancing overall movement efficiency and reducing the risk of NSLBP (7, 28). For example, targeted exercises like hip flexor stretches and posterior pelvic tilts can correct anterior pelvic tilt, restore lumbar lordosis, and reduce lower back strain (7).

4.4. Patient Education

Educating patients on the benefits of postural variability and the importance of movement in pain management is crucial (1, 40). Patients should understand that maintaining a single "correct" posture is less beneficial than adapting their posture to different tasks and environments. This education empowers patients to make informed decisions about their movements and postural habits, ultimately leading to better management of NSLBP (30, 40). Yang et al. (43) emphasize the importance of addressing cognitive and emotional factors, such as pain beliefs and fear-avoidance behaviors, alongside physical interventions in NSLBP management.

Incorporating the JBJA into clinical practice requires a paradigm shift from static posture correction to dynamic posture change. This holistic approach not only alleviates NSLBP but also enhances overall functional movement and reduces the risk of future musculoskeletal issues (2, 16). By focusing on individualized assessment, dynamic interventions, functional training, and patient education, clinicians can provide more effective and sustainable NSLBP management.

5. CONCLUSION

The JBJA offers a paradigm shift in NSLBP management by emphasizing dynamic posture change over static correction. This aligns with contemporary pain science and biomechanics, recognizing the interconnectedness of the body's joints and their impact on movement dysfunction. JBJA interventions target these

dysfunctions through exercises promoting mobility, stability, and motor control in key joints like the hips and thoracic spine. This focus on adaptable movement strategies aims to enhance overall function and resilience of the musculoskeletal system, potentially leading to more sustainable pain relief and improved functional outcomes compared to traditional static approaches. While further research is warranted to explore the long-term effectiveness of JBJA across diverse populations and in combination with psychosocial interventions, initial evidence suggests promise. Future studies should investigate the optimal exercise selection and program design within the JBJA framework for various NSLBP presentations. Integrating this approach into evidence-based practice, alongside ongoing research efforts, holds significant potential for developing more effective and personalized NSLBP management strategies.

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Not applicable.

CONSENT FOR PUBLICATION

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COMPETING INTERESTS

None.

AUTHORS' CONTRIBUTIONS

Conceptualization, W.D. and JP; writing - original draft preparation, W.D. and JP; writing - review and editing, W.D. and TB; supervision, LC; project administration, W.D. All authors have read and agreed to the published version of the manuscript.

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